rapidly over it; the latter operates to give vertical motion or component or velocity to air masses which are potentially unstable. Such unstable air may be found in a dry condition in adiabatic convection resulting from overheating at the base or supercooling at the upper levels, or in a condensation condition within clouds which are the scene for the making of rain or snow and therefore characterized by potential temperatures which may be highly unstable; and another variety is reported by airmen to exist within a thin waferlike stratum of air which appears to act as a friction zone between wind drifts sometimes high aloft containing air of radically different velocities and temperatures, usually and perhaps always with the warmer on top.

From which source did the roughness of October 12 come? The reports point clearly to excessive condensation, and the pilots affirm the presence of the worst roughness within the clouds; the conclusion urged upon us is that the condensation-convection process was violent here. The weather map of 8 a. m. shows a $\frac{6}{10}$-inch barometric gradient across the 400-mile airways. The isobars run NNE.–SSW. and across them [1] races a 20 to 40 mile per hour SE. wind bearing heavy burden of sea-source air. Up to 7,500 feet the wind veered but slightly and increased in velocity. Temperatures were unseasonably high and moisture kept equal pace. A secondary formation in the lower end of a trough of low pressure extending to northwest Florida may have been one agency which held the east component in the circulation; at any rate such widespread SE. wind is uncommon.

The mountain effect on swift-moving air may well be the other source, for with increased horizontal movement comes increased vertical components when such winds climb up and roll down the hills. Too, the ridges in this particular region generally are directed NE.–SW., or nearly transverse to the motion of the air, with the result that it was turned the more abruptly upward.

On November 17, 1927, at about 6 p. m., a mail-plane pilot met with severe bumpiness while over the vicinity of Reading, Pa. A small but severe wind squall, possibly a tornado, occurred northeast of Reading about that time. The bumpiness was less extensive than that of October 12 (as were the contributing causes), but equally violent and probably of similar origin.

[1] The author refers, of course, to surface winds; the gradient winds, say, above 1,500 feet, undoubtedly had a southerly component and thus a direction more nearly parallel with the direction of the isobars.—ED.

THE GROWTH OF THE NORTHEASTWARD-MOVING CYCLONE IN EASTERN NORTH AMERICA

By W. J. HUMPHREYS

It is a well-known fact that many cyclonic storms greatly increase in size and intensity as they move with a northward component across the United States east of the Mississippi River and over eastern Canada, or along the Atlantic coast. This development of the cyclone with increase of latitude is less marked in most other parts of the world, and in many places practically, if not quite, nonexistent.

Naturally, one might suspect that this marked development is somehow caused by the increase, with increased latitude, of the "deflective force" due to earth rotation. But this force increases by less than 25 per cent as the storm passes from latitude 35° to 45°, for instance, a quantity which, when we take into account, as we must, the cyclostrophic effect, would require only small changes of isobars or wind velocity, and not the great changes that so often occur in eastern North America and on the western Atlantic. Besides, this latitude effect is common to all parts of the earth, while the great growth of the cyclone with increase of latitude is not. The rapid increase in extent and intensity of the northeastward-moving cyclone in the region mentioned must, therefore, depend chiefly on some other cause than the incidental increase of earth deflection.

That cause is suggested by the structure of the extratropical cyclone and the topography of North America. That is, this storm, essentially a swirling passage by each other of a broad and relatively cold polar wind to the west and north, and an equally broad, warm equatorial wind to the south and east, necessarily varies with the contrast in temperature between the two currents and the availability of the air supplies.

As the storm moves to higher latitudes the polar winds have come shorter distances and warmed less, while the temperature of the equatorial winds is largely maintained by condensation. Hence with increase of latitude the temperature contrast of the winds tends to become greater, and therefore the winds stronger if the supply of each current is ample. Now, in the eastern United States and Canada and over the western Atlantic cyclonic storms often move rapidly northeastward, thus increasing the temperature contrasts; and in this region also there is free access, without mountain barrier, to cold air (especially in winter and spring) all the way to the Arctic Ocean. Furthermore, substantially the whole of this vast reservoir is on land and ice, hence its air is very cold. Similarly, the access here to the warm air from the Gulf of Mexico and Atlantic Ocean also is very easy and the air quite humid.

In short, over the region in question cyclones often move northeastward rapidly and increase in temperature contrast, while both the warm and the cold branches of the circulation are but little obstructed and from "inexhaustible" supplies. Such storms, therefore, increase with increase of latitude.

In most other parts of the world the opportunities for increasing temperature contrast between the two portions, polar and equatorial, of the cyclone are not so great, nor the air currents so free from obstruction and from such vast reservoirs. Hence the poleward-moving cyclone grows faster and to a greater extent in eastern North America and over the western Atlantic than in almost any other portion of the world.